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Early Fires in Eastern United States

THE OCCURRENCE AND CAUSES OF FOREST AND GRASS FIRES IN THE EASTERN UNITED STATES WITH PARTICULAR REFERENCE TO COLONIAL DAYS

SOUTHERN FOREST EXPERIMENT STATION

NEW ORLEANS, LOUISIANA

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Southern Forest Experiment Station.

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Introduction

What has been the fire history of the forest and grass lands in the eastern section of the United States? How often have fires occurred in the past, both before and since the coming of the white man? Evidence of early fires can be found today in the healed-over fire scars where old-growth timber is being harvested. The accounts of the early settlers often mention that the Indians burned the woods. What reasons lay back of the Indians' fires? How widespread were the fires, and what effect did they have on the ground vegetation and on the forest? Many reasons have been given for the widespread practice of woodsburning that has continued since Colonial times and that even today is responsible for a large proportion of the fires and area burned in this section of the country. Answers to the above questions are important in forecasting the possible effect of complete exclusion of fire over extensive areas of forest land in the eastern United States, which is being brought about as a result of fire protection activities.

Protection from fire has been under way in parts of the eastern United States for many years and the forest area under organized fire protection has increased rapidly since about 1911, following passage of the Weeks law. That legislation provided for the first time an opportunity for the states and forest landowners, with the aid of the federal government, to cooperate in protecting privately-owned forest land from fire. At present (1934) there are

about 221 million acres of land under fire protection east of the Rocky Mountains, or slightly more than half of all the land considered to be in need of protection.

No fire protection system yet devised assures absolute elimination of fires from forest areas. During the 4-year period from 1931 to 1934, of the total area protected in the eastern United States, 1.6 percent burned over annually, according to estimates of the United States Forest Service. Of the unprotected area, it is estimated that 22 percent burned over annually during the same 4-year period. As the extent of land under organized fire protection increases, and with continued improvements in fire prevention and suppression practices, the area burned over annually can be expected to decrease.

In order to find out how frequently forest and grass fires occurred in the past, and to assemble information on the reasons for burning as practiced by the Indians and early white settlers, many of the writings of early explorers and historians have been reviewed and a number of references on fire have been extracted from these documents. In the following discussion, quotations are given from a number of historical writings which show some interesting sidelights on the frequency and causes of early fires, as well as on the development of woodsburning--a custom which still prevails in many parts of this country, particularly in the southern states.

Lightning Fires

The belief that forest fires have occurred since prehistoric times was stated by Plummer (48) in one of the earliest studies (1912) made by the United States Forest Service on the causes of forest fires:

> "It is probable that forest fires have occurred ever since there were forests. When wood has been reduced to charcoal, its structure may be preserved indefinitely. It is in the coal formations that some of the earliest evidences of fire may be found, while a substance resembling charred wood has been unearthed in a subcarboniferous sandstone, on the eastern side of the 'Thumb' of Michigan. Wood found in the Pleistocene formation 'showed the effect of fire, indicating the result of a forest fire.' (Notes on Tertiary Plants from Canada and the United States, by D. P. Penhallow, Proceedings and Transactions of the Royal Society of Canada, p. 75, 1905). The charcoal of peat bogs in North America and New Brunswick, some of which are estimated to be from 2,000 to 3,000 years old, also indicates the occurrence of forest fires in the far distant past. Thus, step by step, from the subcarboniferous sandstone to the quaternary peat, charcoal presents its evidence of fire, just as the unbroken record continues from trees older than the peats to those of the present day."

In the same publication Plummer set forth two principal causes of these early fires:

> "At least two causes of fires operated in ancient times-lightning and Indians. The practice of Indians in firing forests, prairies, or swamps was to permit the growth of berries, to drive game, and occasionally to impede an enemy. That this practice was continued long after the advent of the whites is shown by many accounts of such fires in the early history of America."

Henry and others, of the United States Department of Agriculture, in a discussion of weather and agriculture (26), have the following to say about lightning fires, and explain why fires from this cause are more common in the western states than in the East:

> "Lightning. - Second only to the influence of weather upon the spread of fire is the harm one phase of weather creates in starting fire. All but one of the many and varied causes of fire are attributable to man and therefore, are preventable with care. The one natural cause over which man has no control is lightning.

"The East has relatively a much smaller percentage of lightning fires than the West. This is due to two main causes: (1) The character of the storms and (2) the character of the forest. In many parts of the West a thunderstorm is accompanied by very little rain, often insufficient to wet down the forest and keep the litter and debris in the forest from burning. In the East most thunderstorms are accompanied by copious rainfall, which prevents lightning fires from really becoming serious. The forests of the West, too, contain many "snags" or standing dead trees. These are not perhaps struck any more often than are green trees, but when the wood is rotten it catches fire readily and smoulders for some time before breaking out."

Van Hise, in his well-known book on the conservation of natural resources, (69) recognized lightning as a source of early fires, and also gave a number of other reasons for these fires:

"You will doubtless be surprised to learn how numerous were the fires caused by lightning. This explains some of the old fires, those of the time before settlement."

"The loss of timber due to fire has been practically the same as the amount of timber used. However, lightning is not the only cause of fires before the settlement of the country by white men. The Indians had a habit of burning over the forest each year. Thereby, the forests were made open and the prairies extended at the expense of the forest. If the forests are kept free from fires, they soon become difficultly accessible, both to man and to beast. In the South for a similar reason, the white man burns over the forest land each year in order to improve grazing of herds."

A picturesque description of the beginning of a lightning fire is given in the writings of William Bartram, (68) who traveled extensively through the Southeast in Colonial days. Bartram observed this lightning fire in southeastern Georgia in the year 1773; it was of short duration on account of the rain which followed almost immediately:

"Stepping to the door to observe the progress and direction of the tempest, the fulgour and rapidity of the streams of lightning, passing from cloud to cloud, and from the clouds to the earth, exhibited a very awful scene; when instantly the lightning, as it were, opening

a fiery chasm in the black cloud, darted with inconceivable rapidity on the trunk of a large pine-tree, that stood thirty or forty yards from me, and set it in a blaze. The flame instantly ascended upwards of ten or twelve feet, and continued flaming about fifteen minutes, when it was gradually extinguished by the deluges of rain that fell upon it."

Frequency of Early Fires

That forest fires must have been common to the longleaf pine forests of the South during prehistoric times is stated by Harper (23). He also gives his opinion of the frequency of fire in prehistoric times as compared to that during the period since settlement first took place:

> "All the longleaf pine forest of which I have any knowledge (and I have seen them in seven of the nine states and about 200 out of some 300 counties in which *Pinus palustris* is found), even the more or less isolated ones in the mountains of Georgia and Alabama, bear the marks of frequent fires. In prehistoric times these fires were doubtless set by natural agencies, probably mostly lightning, and each spot perhaps did not get burned over oftener than once in several years, on the average. Although fires may not be started by lightning on any one square mile oftener than once in several decades, a fire once started in the grassy carpet of an unbroken pine forest might easily spread over several square miles, so that every acre of such forest, if not protected in some way, would be likely to be burned over every few years. Forest fires are now usually set by man, sometimes purposely and sometimes accidentally, but the increase in number of fires due to this cause has been partly counterbalanced by the numerous highways, clearings, etc., which serve as barriers to fires, so that the frequency of fire at any one point in the pine-barrens may not be over two or three times as great as it was in prehistoric times, and the geographical distribution of forest fires in the southern states has probably not been changed materially."

Wherry's studies in North Carolina (72) indicated that prehistoric fires came at relatively infrequent intervals, although he believes that these fires influenced the establishment of the pine forests of the Coastal Plain:

> "No doubt the great pine forests of the coastal plain got started in the first place when particularly severe fires destroyed whatever deciduous climax forest formerly occupied the areas; but the infrequency of charred rings

in stumps and of charcoal layers in peat deposits shows that before the white man came, fires occurred only at intervals of many years."

In the same region (North Carolina) Wells and Shunk (71) also found evidence of fire during prehistoric days:

> "In this connection it is of the greatest importance to know that fire was not uncommon during prehistoric days. Evidence for this is very clear from old records. The descriptions of savannahs or grass sedge bogs are frequent and since this community cannot come into existence or be maintained without fire, this alone is conclusive evidence of fire."

Mohr, one of the early investigators of the Division of Forestry of the United States Department of Agriculture, in an exhaustive study of the southern pines (37) gave a number of reasons for the prevalence of fire in the southern states, and commented on the frequency of burning. His studies were made over a period of several years prior to the publication of his material (1897):

> "Besides the production of naval stores as a cause of forest fires, there is another scarcely less potent. This is the practice prevailing among the settlers of burning the woods upon the approach of every spring in order to hasten the growth of grass for their famished stock. Fires are also frequently started through the carelessness of loggers and hunters, in the preparation of the ground for tillage, and by sparks from locomotives. <u>These fires occur at least once during every year.</u>"

Use of Fire in Hunting

Many of the records of the early explorers mention that the Indians used fire in hunting, either to attract the game to certain spots or, by surrounding the animals with fire, to kill them the easier. Probably the first record of this kind in America was set down by the Spaniard, Alvar Nunez Cabeza de Vaca, (4) who lived among the Indians in Florida and farther west during the period 1528 to 1536, after which he returned to Europe and wrote down his experiences:

"In the same manner, they kill deer, encircling them with fires, and they do it also to deprive the animals of pasture, compelling them to go for food where the Indians want. For never they build their abodes except where there are wood and water, and sometimes load themselves with the requisites and go in quest of deer, which are found mostly where there is neither water nor wood."

A description of Indian hunting with fire was set down by one Henry Spelman who came to Virginia as a boy and was captured by the Indians in 1614 (28):

"Ther maner of Huntinge is thiss they meet sum 2 or 300 together and hauinge ther bowes and arrows and euery one with a fier sticke in ther hand they besett a great thickett round about which dunn euery one sett fier on the ranke grass which ye Deare Seinge fleeth from ye fier and the menn cumminge in by litell and litle incloseth ther game in a narrow roome so as with ther Bowes and arrowes they kell them at ther pleasuer."

Arber's book about Captain John Smith (2) also tells of the Indian method of hunting, in Virginia, at about the same period:

"At their huntings in the desert they are commonly two or three hundred together. Having found the Deere, they envision them with many fires and betwixt the fires they place themselves. And some take their stands in the midsts. The Deere being thus feared by the fires, and their voyces, they chase them so long within that circle, that many times they kill 6, 8, 10, or 15 at a hunting."

A description of Indian hunting in what is now central Illinois (along the course of the Illinois River, near the Indian village of Illinois, which was 30 leagues from Fort Miamis--now Chicago) was written in December 1679, according to Hennepin (25):

"When the savages discover a large number of those Beasts together (wild bulls) they likewise assemble their whole tribe to encompass the Bulls and then set on fire the dry Herbs about them, except in some places, which they leave free; and therein lay themselves in ambuscade. The bulls seeing the flames about them run away through those passages where there is no fire; and there fall into the hands of the sav-

ages, who by these means will kill sometimes about sixscores in a day. They divide these Bulls according to the number of each family; and send their wives to slay them and bring the flesh to their cabins. The women are so lusty and strong that they carry on their backs two or three hundred weight, besides their children and notwithstanding their Burthen run as swiftly as any of our soldiers with their arms."

Byrd, while establishing the boundary line between Virginia and North Carolina, under date of November 10, 1728, wrote in his diary (8) as follows:

"In a Dearth of Provisions our Chaplain pronounc'd it lawful to make bold with the Sabbath, and send a Party out a-Hunting. They fired the Dry Leaves in a Ring of five Miles' circumference, which, burning inwards, drove all the Game to the Centre, where they were easily killed.

"It is really a pitiful Sight to see the extreme Distress the poor deer are in, when they find themselves Surrounded with the Circle of Fire; they weep and Groan like a Human Creature, yet can't move the compassion of those hard-hearted People, who are about to murder them. This unmerciful Sport is called Fire Hunting, and is much practiced by the Indians and Frontier Inhabitants, who sometimes, in the Eagerness of their Diversion, are Punish't for their cruelty, and are hurt by one another when they Shoot across at the Deer which are in the Middle."

William Bartram, one of the early English travelers in the United States, described in great detail his observations on plant and animal life in Georgia and Florida (68). While descending the St. Juan River in Florida about the year 1773, he mentions the frequency of fire, caused by the Indians to arouse game, and by lightning:

"These birds (vultures) seldom appear but when the deserts are set on fire (which happens almost every day throughout the year, in some part or other, by the Indians, for the purpose of rousing the game, as also by the lightning): when they are seen at a distance soaring on the wing, gathering from every quarter, and gradually approaching the burnt plains, where they alight upon the ground yet smoking with hot embers; they gather up the roasted serpents, frogs, and lizards."

An account of the use of fire in hunting near the Hudson River, as told by the Duke de la Rochefoucault Liancourt, in 1796,(50) indicated that these fires often caused considerable damage to the settlements:

> "It also frequently happens that conflagrations are caused in the woods by the hunters, who, for the purpose of more certainly killing the deer, surround with fire the places where they suppose them to be. Some of these lines of fire are several miles in circumference: their breadth is inconsiderable; for however narrow they may be, the deer never cross them. The hunters generally adopt the necessary precautions to prevent the flame from communicating; but sometimes those precautions are neglected; sometimes also, although they have been observed, a sudden wind spreads the fire, which often consumes the entire inclosure, and even great tracts beyond its bounds, involving in the conflagration all the settlements and houses it meets in its way, and thus reducing many families to ruin."

The custom of fire hunting in Kentucky, and in other parts of North America, was described by Michaux (57) following a journey in 1801-1803. He pointed out the danger of such fires and the method of backfiring used by both Indian and white hunters for their own protection:

> "The custom of burning the meadows was formerly practised by the natives, who came in this part of the country to hunt; in fact, they do it now in the other parts of North America, where there are savannas of an immense extent. Their aim in setting fire to it is to allure the stags, bisons, etc., into the parts which are burnt, where they can discern them at a greater distance. Unless a person has seen these dreadful conflagrations, it is impossible to form the least idea of them. The flames that occupy generally an extent of several miles, are sometimes driven by the wind with such rapidity, that the inhabitants, even on horseback, have become a prey to them. The American sportsmen and savages preserve themselves from this danger by a very ingenious method; they immediately set fire to the part of the meadow where they are, and then retire into the space that is burnt, where the flame that threatened them stops for the want of nourishment."

Hunting with fire was very general among all the Indian tribes and was also used by the whites in Virginia, according to a letter written by Thomas Jefferson to John Adams, on May 27, 1813 (38):

"You ask if the usage of hunting in circles has ever been known among any of our tribes of Indians? It has been practiced by them all; and is to this day, by those still remote from the settlements of the whites. But their numbers not enabling them, like Genghi Kahn's seven hundred thousand, to form themselves into circles of one hundred miles diameter, they make their circle by firing the leaves fallen on the ground, which gradually forcing the animals to a center, they there slaughter them with arrows, darts, and other missiles. This is called fire hunting, and has been practised in this State (Virginia) within my time, by the white inhabitants. This is the most probable cause of the origin and extension of the vast prairies in the western country, where the grass having been of extraordinary luxuriance, has made a conflagration sufficient to kill even the old as well as the young timber."

Nuttall, (59) while traveling near Fort Smith, Ark., (on the boundary of Oklahoma) in April 1819, commented on the practice of annual burning by the natives, for the purpose of making hunting easier as well as to attract game:

"The numerous rounded elevations which chequer this verdant plain, are so many partial attempts at shrubby and arborescent vegetation, which nature has repeatedly made, and which have only been subdued by the reiterated operation of annual burning, employed by the natives, for the purpose of hunting with more facility, and of affording a tender pasturage for the game."

The Indian practice of burning to attract game is considered by the historian, Carrier, (9) as a first step toward pasture management:

"The Indian practice of burning areas to attract deer, elk and buffalo with the succulent growth of grass which sprang up after the fire had passed might be cited as a step toward pasture management."

Another authority for fire hunting by the Indians in Virginia is Jones (31):

"The whole country is a perfect forest, except where have been formerly Indian towns, and poisoned fields and meadows, where the timber has been burnt down in fire hunting or likewise...."

In a letter written by Father Pierre Jean de Smet in 1841, (64) while on a journey beginning at the eastern border of Kansas and extending to the Far West, he contrasts the country south of the Platte River in Nebraska, where the Indians fired the prairie each autumn, with the Far West country, where that practice is not followed:

> "This intimate connection between rivers and forests is so striking to the eye, that our beasts of burden had not journeyed more than eight days through the desert, when we saw them in some manner exult and double their pace at the sight of the trees that appeared at a distance. This was chiefly observable when the day's journey had been rather long. This scarcity of wood in the western regions, so much at variance with what is seen in other part of North America, proceeds from two principal causes. In the plains on this side of Platte River, from the custom which the Indians who live here have adopted, to fire their prairies towards the end of autumn, in order to have better pasture at the return of spring; but in the Far West, where the Indians do not follow this practice, (because they fear to drive away the animals that are necessary for their subsistence, or to expose themselves to be discovered by the strolling parties of their enemies,) it proceeds from the nature of the soil, which being a mixture of sand and light earth, is everywhere so barren that with the exception of the absynth (the page-brush (Artemisia tridentata), that covers the plains, and the gloomy verdure that shades the mountains, vegetation is confined to the vicinity of rivers,- a circumstance which renders a journey through the Far West extremely long and tedious."

Another description of autumn hunting fires by the Indians on the prairies is given by Dodge (14):

> "The Indians in their great autumn hunts set fire to the prairie to signal their friends that they had found buffalo, or with the object of more effectually bringing the animals together by limiting their feeding grounds, thus reducing the labor of the hunt."

Coues (12) states that the Indians burned the Plains every spring, to attract buffalo with fresh grass:

> "Every spring the plains are set on fire and the buffalo are tempted to cross the river in search of fresh grass which immediately succeeds the burning. On their way they are often isolated on a large cake or mass of ice, which floats down the river. The Indians now select

the most favorable point for attack, and as the buffalo approaches dart with astonishing agility across the ice, sometimes pressing lightly on a cake of not more than 2 feet square. The animal can make but little resistance, and the hunter who has given him his death wound paddles his icy boat ashore and secures his prey."

A description of southern Indiana at the time fall fires set by Indian and white hunters were burning was written down by Faux, (58) in November 1819.

"The season, called the Indian summer, which here commences in October, by a dark blue hazy atmosphere, is caused by millions of acres, for thousands of miles round, being in a wide-spreading, flaming, blazing, smoking fire, rising up through wood and prairie, hill and dale, to the tops of low shrubs and high trees, which are kindled by the coarse, thick, long, prairie grass, and dying leaves, at every point of the compass, and far beyond the foot of civilization, darkening the air, heavens and earth, over the whole extent of the northern and part of the southern continent, from the Atlantic to the Pacific, and in the neighborhoods contiguous to the all-devouring conflagration, filling the whole horizon with yellow, palpable, tangible smoke, ashes, and vapour, which affect the eyes of man and beast, and obscure the sun, moon, and stars, for many days, or until the winter rains descend to quench the fire and purge the thick ropy air, which is seen, tasted, handled, and felt."

"So much for an Indian summer, which partakes of the vulgar idea of the infernal. Why called Indian? Because these fires seem to have originated with the native tribes, and are now perpetuated by the White Hunters, who by these means start, disturb, and pen up the game, and destroy the dens of both man and beast, and all this with impunity. Tomorrow, through floods and flames, I shall endeavor to make good my desperate way to the retreat of my good friend in Evansville (Indiana)."

"We rode all day through thick smoke and fire, which sometimes met in pillar-like arches across the road, and compelled us to wait awhile, or turn aside. We passed only one comfortable abode, and three or four one-room log-holes, surrounded by small patches, cleared samples of the bulk, which seems good land."

That hunters used fire in western Florida was stated by Eldredge, (19) the first Supervisor of the Florida National Forest:

"The camp hunters, of whom there is a large number during the fall and winter months, set out fires in order to drive out game from the thickets."

Fire for Clearing Land

Fire has long been used in killing forest growth preparatory to clearing land for agriculture. The method used by the Indians, which prevailed generally in eastern North America, is given by the historian Carrier (9):

> "The Indians were able to clear land overgrown with trees without saws, axes or other tools of metal. Capt. John Smith states that they accomplished this by first bruising the bark near the roots and then scorching them with fire. By this method they had made extensive clearings in the eastern part of the continent."

These fires used in clearing were not always held within bounds. The Duke de la Rochefoucault Liancourt describes what he saw along the Hudson River, New York, in 1796 (50):

> "From our windows we discover, though above 7 miles distant, the light of a conflagration in the woods, which has already lasted 8 days. Such accidents are very frequent in the clearing of lands by the aid of fire. The slightest inattention suffers the blaze to spread beyond the intended bounds; in which case it is impossible to extinguish it, especially at this time when the drought and the falling of the leaves furnish it with the means of rapidly extending its ravages."

Another description of early Indian fires was made by Percy (45) in writing a history of an expedition to Virginia which left London in December 1606. They landed in Virginia in March 1607, and the following observation refers to the peninsula between the James River and Chesapeake Bay:

> "Wee marched some three or four miles further into the woods, where we saw great smoakes of fire. Weemarched to those smokes and found that the Savages had beene there burning downe the grasse, as wee thought either to make their plantation there, or else to give signes to bring their forces together, and so to give us battell."

Lambert, (32) in 1807, described how a fire used for clearing in southeastern Georgia got out of control:

"The sun rose about 6 o'clock, but it was a considerable time before the dewy vapours, which had covered the ground during night, were dispersed. About an hour after, while yet in the midst of an extensive pine barren, we were suddenly enveloped in what we at first supposed to be a thick fog; but as we proceeded further on, we discovered it to be the smoke of a large fire in the forest. No flames, however, were discernible anywhere; and as we rode on, the smoke continued to thicken, insomuch that we could not see the two leaders; and it was with great difficulty we could draw our breath. Unaccustomed to such a scene, Mr. Chapman and I began to hesitate about going any further, for we expected every moment to be surrounded by the flames which had created such an immense body of smoke. Unfortunately, this was the only road, unless we had returned back to Pocotaligo, and gone down the road to Beaufort, which branches off towards Ashepoo bridge; but this would have delayed us a whole day, and the coachman expected every moment to arrive at a log hut, to change horses, and where he meant to inquire whether the fire extended across the road, and would prevent us from passing.

"We had now road upwards of three miles through this thick cloud of smoke, and should have passed the hut, had not a negro been waiting on the roadside for our arrival. Here we alighted while the horses were changing, and went into the hut, which was inhabited by two negroes employed to take care of the horses; they informed us that the forest had been set on fire a day or two before, to clear the ground of the long grass and brushwood, and it being very dry weather, the fire had spread further than was intended: they did not think that it had reached the road, though the smoke had settled in the forest, in consequence of there being no wind to disperse it. I could not help pitying the situation of these two poor fellows, who resided in the neighborhood of such dreadful conflagration."

Burning to Improve the Range

Probably the most common cause of forest and grass fires from the time of the early settlers, has been to improve the range for livestock. It is well known among stockmen that cattle tend to congregate on freshly-burned range, where the new grass is more readily available. References to burning for this purpose are common in the literature and a few representative examples referring to various localities, will be quoted here.

Sargent, in an exhaustive report on the forests of North America, published as part of the Tenth Census of the United States, in 1884 (53) includes the following statements:

> "The custom of turning domestic animals into the forest to pick up a scanty and precarious living, common in all parts of the country, is universal in the southern and central portions of the Atlantic region."
>
> "The pasturage of the forest induces the burning over every year of great tracts of woodland, in order to hasten the early growth of spring herbage."
>
> "In the south Atlantic region annual fires have been allowed to run through forests of the longleaved pine to improve the scanty pasturage they afford. Stockmen have been benefited at the expense of the permanency of the forest."

Cary (10) tells how the custom of woodsburning by owners of livestock in the South came about in the early days, and was looked on as an inherent privilege:

> "We all know how nearly universal annual fire has been in great portions of the South, on what vast areas it has prevented the reproduction of timber. Most are familiar too with the conditions under which this practice of woods burning grew up, as an adjunct to a primitive stock industry conducted by a pioneer people, - families widely detached in native woods, ownership to the ground beyond their own small ownership not strongly asserted, treatment to their own wish of all territory about looked on as a prerogative. In its time and place the practice perhaps did serve the people and through them the country. With the native forest cut off, however, reproduction needed, and relative values for stock and for timber reversed, this practice is highly destructive today."

Carrier, the historian, in quoting from a publication (1775) by Rowans (9) on grazing conditions in Florida, believes that the same conditions prevailed even before the coming of the whites:

> "Rowans, (52) gives an excellent description of Florida grazing conditions. Describing the pine land or pine barrens, he says:

'It is on this kind of land, that immense stocks of cattle are maintained, although the most natural grass on this soil is of a very harsh nature, and the cattle not at all fond of it, it is known by the name of wire grass; and they only eat it while young; for the procuring it young or renewing this kind of pasture the woods are frequently fired, and at different seasons, in order to have a succession of young grass, but the savannas that are interspersed in this kind of land furnish a more plentiful and more proper food for the cattle.'

"As these conditions still prevail over large areas in the southern coastal plain it must be accepted that they were the same before the white men penetrated that region."

A picture of the primitive livestock industry carried on by the early southern planters in South Carolina is given by the Duke de la Rochefoucault Liancourt, in 1796 (51):

"All the planters keep great numbers of oxen, cows, and pigs, which procure their food easily, and without the least expense, in the large forests, which belong to the plantations. Horses are also frequently turned into the woods; but the true amateurs of horses, many of whom are found among the planters, send them rather to graze on a field, which the year before was sown with Indian corn and rice, and on which the species of grass, called crab grass, grows in great plenty. In woods, where the grass of the preceding year is not entirely consumed, and where this grass might stifle the new growth, it is burnt at the beginning of spring, and the young grass thrives better than it otherwise would do."

Andre Michaux, in writing of his travels through Kentucky in 1802, (57) gave the reasons why the inhabitants of that day burned over the Big Barrens district in west-central Kentucky every spring. He also mentioned that not all of the people agreed as to the wisdom of this custom:

"Every year, in the course of the months of March or April, the inhabitants set fire to the grass, which at that time is dried up, and through its extreme length, would conceal from the cattle a fortnight or three weeks longer the new grass, which then begins to spring up. This custom is nevertheless generally censured; as being set on fire too early, the new grass is stripped of the

covering that ought to shelter it from the spring and frosts, and in consequence of which its vegetation is retarded."

While traveling through Arkansas in 1819, Thomas Nuttall, a famous American naturalist, made the following observations with regard to the prevalence of fire (59). Near Little Rock, on March 8, 1819, he wrote:

> "The woods, which had been overrun by fire in autumn, were strewed with herbage, already an abundant pasture for cattle."

A little later, on April 7, 1819, near Dardanelle (Yell County):

> "The fires which commonly take place mong the dry herbage and which had but recently been in action, prevented me from making any botanical collections."

In describing a part of the pine belt in South Carolina (about 100 miles inland from the coast) Hammond, (21) in a statement prepared for the Tenth Census of the United States, (1884) told how the early settlers followed the Indian custom of winter woodsburning for their cattle:

> "The early settlers in this region were stock raisers, and kept up the Indian practice of burning off the woods during the winter. The destruction of the undergrowth by this means favored the growth of grasses, and numerous herds of almost wild cattle and horses found abundant pasturage chiefly upon what was known as the wild oat, and the wild pea vine. The cattle were sometimes slaughtered for their hide and tallow.... The uplands were covered, as they still are, with a large growth of yellow pine, and a deer might have been seen in the vistas, made by their smooth stems, a distance of half a mile; where now, since the discontinuance of the spring and autumn fires, it could not be seen 15 paces, because of the thick growth of oak and hickory that has taken the land."

The practice of spring woodsburning was common in Florida in 1889, according to Harcourt (22):

> "All over the State it is the custom to "fire the woods" early in the spring, so that the pine straw and old grass may be burned off, and new grass, the famous wire-grass, grow up, so that, forsooth, the roving stock may find plenty to eat without money and without price, so far as their owners are concerned."

Nash (44) in referring to the country around Lake County, Fla., in 1895, stated:

> "The high pine land is subject to annual fires. The cattle growers burn off the old grass, so that the roots will start up and give a crop of young, succulent shoots."

Another reference to fires by cattle owners in Florida is taken from Drew (16):

> "Cattle owners over the State have from the earliest settlements burned the grass during the winter months; and wiregrass, which is indigenous to the soil when fully grown, has little or no value as a food grass, but when putting forth after burning, is very succulent."

In discussing the fire problems on the Florida National Forest in the extreme northwestern part of the state, shortly after that forest was established, Eldredge (19) stated:

> "The popular sentiment of the residents within the Florida National Forest, in common with nearly all of the people of the South, is unqualifiedly in favor of the annual burning over of the pineries. The homesteader and cattleman burn the woods to keep down the blackjack undergrowth and to better the cattle range. These different classes of people have for a great number of years been accustomed to burning the woods freely and without hindrance of any kind, and it is done without the knowledge or the feeling that they are breaking the laws or in any way doing damage. On the contrary they all have the most positive belief that burning is necessary and best in the long run."

Fires in eastern North Carolina were generally set by stockmen, according to Pinchot and Ashe (47):

> "The majority of the fires which sweep across the barrens in Eastern North Carolina with such destruction are purposely set to remove dried grass and herbage in the spring and afford cattle the tender first shoots of the year for pasturage."

Harper (23) tells of the same custom in Georgia, but indicates that the practice was not approved by everyone:

"But the fires which are (and have been for several centuries, it is said) started every winter or spring in order to burn off the dead leaves of the wire grass so that the cattle can more readily get at the new growth, are a more serious matter. These fires are of course mostly confined to the dry pine-barrens, but in a very dry weather they may burn well down toward the swamps and even through cypress ponds. On sand-hills there is practically no grass to burn, and the dead leaves probably do not accumulate there fast enough to allow of a fire every year."

"Opinions are divided even among the natives of the wire-grass country, as to the desirability of burning off the grass each year, but those who believe in this ancient practice usually act accordingly, and the others are powerless to stop it."

The stockmen's fires in South Carolina were so customary that Tilghman (66) anticipated a long fight before they could be stopped:

"The intentional setting of fires to improve pasturage is an old custom in this state."

"The advocates of this practice of willful woods burning will doubtless put forward the argument that it accomplishes the removal of surface litter and debris, and thus either entirely removes or materially lessens the fire risk."

"Without doubt, the extirpation of the custom would benefit South Carolina and her neighboring states materially. But it has obtained for many years and unfortunately its roots are most deeply imbedded in the minds of a section of the population which it is going to be most difficult to reach."

"But the fight will be a long one, for it is usually difficult to alter the custom of generations."

In one of the early Forest Service studies (1905) in South Carolina, Chapman (11) found no active opposition to the spring burning custom, although some believed it to be short-sighted.

"Ever since the settlement of this country it has been customary to burn over the pine lands in the early spring, to improve pasturage and to prevent the growth of underbrush. This custom is now acknowledged by many of the inhabitants to be short-sighted, but there is

still a lack of active opposition to the practice, and fires continue to be set by negroes and people not interested in lumbering or agriculture. The tall growth of grass under the open stands of pine makes the starting of fires very easy; many are consequently accidental in origin.

"Swamps and bottoms have been harmed little, for they are seldom dry enough to burn, but even here fires have occurred in the past, and only a dry season is necessary for them to occur again."

Dwight, in 1821, (18) found that the white settlers in New England followed the Indian custom of burning to improve the range:

"The plains and the openings in the forest are evidence that the Indians customarily burned, every year such parts of the forests as were sufficiently dry to admit of conflagration."

"I suppose these grounds however, to have been frequently burned by the English inhabitants; who foolishly followed this Indian custom in order to provide feed for their cattle in the spring."

That there was a difference in the use of fire by the Indians and early settlers with those of later settlers, was the opinion of McKinnon (36). In his history of Walton County, Fla., in the extreme western part of that state, he recounts how the first settlers, most of whom came from Scotland to North Carolina about 1810 and on to Florida about 1820, were friendly with the Indians and learned a great deal from them. It was the later settlers, who came about 1840, after the Indians had removed to other sections, who were so reckless with fire.

"The aborigines know better how to take care of their country than the white man does. They never allow the fires to run wild and burn up their range."

"They (the later settlers) went about like vandals, slashing and destroying as they went. The great trouble was, the curse of fire turned loose, to destroy the rich, luxuriant range, which would, if they protected it as the aborigines did, last for generations after generations, and fatten millions and millions of cattle, sheep and hogs from year to year. The Indians took great pains in showing the very first comers how to protect the game, range and

forests and these settlers took great interest in learning how, following their advice. They pointed out to them the great destruction that unbridled fire would do in a little while to the range, killing the rich berries and the low bush sweet apples that were so nutritious to animal life, the deer and gopher apples; how it would stunt the grass after awhile and give place to worthless scrub oaks that would soon kill out the grass altogether. These earliest settlers not only appreciated these lessons, but showed it by going to work strenuously to put them into practise. They would often take their forces from the fields and work for days fighting fire, cutting it off by short cuts between creek and other water protections, to stop the spread and save the grass and rich cane along the titi branches. One would think when they would see such hard work from their earlier neighbors, this would make them more cautious, but with some it seemed not to move them. They would tell them how the aborigines had taught them the value of the range in its natural state, and how they had kept it in its splendid condition, growing better and better all the years. But they thought it ridiculous that an uncivilized Indian could be capable of advising the civilized white man. These men would tell them how it would displease their Indian neighbors to see the game and range destroyed. All this had no effect upon them. The idea, the talk, of these later settlers, in regard to the conservation of Nature's abundant resources, was very displeasing to the early settlers. They had learned by observation and experience the value of protecting these resources, and expostulated with these careless roamers from time to time, with but little result in good."

"And well do you know in these last days they have fallen upon the engine of the greatest destruction of all. They turn loose unbridled the dogs of fire to lap up with their blazing tongues the beautiful range, these great canebreaks, which give such tender, sweet and strong food to the beasts that roam through them, and these cruel, angry flames leap up in their mad wrath to the tops of our highest trees, stripping them of their foliage and even claiming some of them. They make no effort to restrain them or cut them off in their sweep over the range. It is all right with them so that they are not entrapped in the flames. Only once in a half century did these flames get loose from us, and we took them in before they had gone but a little ways. And since the coming of these late ones there has been ever so many of these turn-looses. How often have I seen you and your forces working hard to beat back these ravages of fire and as often did we come to your help to hinder them. But the more do they turn them loose to destroy."

"I showed them that there would in a little while be no winter range for cattle to browse over and keep fat on. They were set in the idea of burning the woods for fresh grass, pointing to the rich fresh grass around their homes that was keeping their cows in good milk all the summer. And when I pointed them to the poor range it would make for the winter, in comparison with the unburned, and how it would destroy the many varieties of huckleberries for hogs and chickens and birds, they would reply 'there are plenty of rough woods just a little ways off, if we find them best.' And I find this is pretty nearly the idea of all these late comers; they seem to be honestly set in their opinions, that there is no harm to giving up the range to the ravages of the flames, and that this land of plenty will continue to bring plenty without protection for ages to come or during their days at least, in which they are mostly interested."

Other Early Fires

The Indians and early white settlers in eastern North America burned the woods for a variety of other reasons and sometimes started fires accidentally. One of the earliest records of use of fire by the Indians is by de Vaca, (4) who lived among the Indian tribes near the Gulf Coast from 1528 to 1536. Small (55) in quoting from de Vaca, compares the burning practices in Florida in 1929 with those of the savages four centuries earlier. According to de Vaca, the Indians used fire to drive away mosquitoes and also to facilitate obtaining food.

"In some ways man has progressed in ideas and in methods within the past few centuries. In other ways he is still typically a 'savage'. Certain methods of life of the savage-uncivilized red man and the savage-civilized white man are identical. The following quotation written (by de Vaca) four centuries ago about the aboriginal red man applies just as well to his pale-faced successor of today.

'Those from further inland go about with a firebrand, setting fire to the plains and timber so as to drive off the mosquitoes, and also to get lizards and similar things which they eat to come out of the soil.' "

Hennepin (25) tells of the Indians setting fire to the dry grass to speed the marching of the whites who accompanied them. This occurred in what is now central Illinois, in December 1679.

> "I was so weak that I often laid me down, resolved to die rather than to follow these Savages any further, who travelled at a rate so extraordinary, as far to surpass the strength European. However to hasten us they sometimes set fire to the dry grass in the meadows through which we passed, so that our choice was to march or burn. I had a hat, which I had taken with me to fence me from the sun during the heat of summer. This would often fall from my head into the fire, because it was not over-fit, and the fire was so very near. The barbarians would snatch it out again and lend me a hand to save me from the flames, which they had kindled, as well as to hasten our march as I have said before."

Lawson (32a) while traveling with some Indians in North Carolina in early Colonial days (1714) stated:

> "I perceived these Indians were in some fear of enemies for they had an old man with them who was very cunning and circumspect, wherever he saw any marks of footing or of any fire that had been made; going out of his way very often to look for such marks.
>
> "We travelled about twenty miles lying near a savannah that was overflown with water: where we were very short of victuals but finding the woods newly burnt and on fire in many places which gave us great hopes that Indians were not far off. Next morning we waded through the savannah."

While Byrd (8) was establishing the boundary line between Virginia and North Carolina he wrote in his dairy about the woods fires which apparently spread accidentally from Indian camp fires.

> "October 20, 1728 - 'The Atmosphere was so smoaky all round us, that the Mountains were again growing invisible. This happen'd not from the Hazyness of the sky, but from the fireing of the Woods by the Indians, for we were now near the Route the Northern Savages take when they go out to War against the Cataubas and other Southern Nations.
>
> 'On their way the Fires they make in their camps are left burning, which, catching the dry Leaves that ly near, soon put the adjacent Woods into a flame.

'Some of our men in Search of their Horses discovered one of those Indian camps by the Smoak, where not long before they had been Furring and dressing their Skins.'

"October 23, 1728 - 'The Mountains were still conceal'd from our Eyes by a cloud of Smoak. As we went along we were alarmed at the Sight of a great Fire, which shewed itself to the Northward. This made our small Corps march in closer Order than we us'd to do, lest perchance we might be waylaid by Indians.

'But the Desolation made there lately, either by Fire or Caterpillars, had been so general, that we could not see a Tree of any Bigness standing within our Prospect. And the Reason why a Fire makes such a Havock in these lonely Parts is this.

'The Woods are not there burnt every year, as they generally are amongst the Inhabitants. But the dead Leaves and Trash of many years are heapt up together, which being at length kindled by the Indians that happen to pass that way, furnish fewel for a conflagration that carries all before it.' "

Another account of woodsburning due to carelessness is given in a letter written by a young British officer, during the Revolutionary War, while he was a prisoner (43). The letter was written at Richmond, Va., on July 14, 1779.

"The town of Richmond, as well as the plantations around for some miles, has been in imminent danger, as the woods have been on fire, which for some time past has raged with great fury, and that element seems to threaten universal destruction; but providentially, before it had done any material damage, there fell a very heavy rain, which nevertheless, has not altogether extinguished it, as it is daily breaking out in places, but not so violent but it can be easily prevented from spreading."

"During the summer months, these fires are very frequent, and at Charlottesville I have seen the mountains on a blaze for three or four miles in length, they are occasioned by the carelessness of wagoners, who, when night approaches, after they have unharnessed the horses, fed them, pannelled them; and tying a bell round their necks, turned them loose in the woods to graze, make a large fire to warm them when they sleep, which on pursuing their journey the next morning, they neglect to extinguish, this communicating to the dry leaves which lay on the

ground, spreads rapidly and causes these dreadful and dangerous conflagrations."

One of the early travelers in Louisiana, du Pratz, (17) spoke of the custom of burning the dry grass in September, which resulted in easier travel and attracted game. The following observations were made in 1759 while journeying from Natchez, Miss., northward through the country of the Chickasaws (northern Mississippi):

> "We set out in the month of September, which is the best season of the year for beginning a journey in this country; in the first place, because, during the summer, the grass is too high for traveling; whereas in the month of September, the meadows, the grass of which is then dry, are set on fire, and the ground becomes smooth, and easy to walk on: and hence it is, that at this time, clouds of smoke are seen for several days together to extend over a long track of country; sometimes to the extent of between twenty and thirty leagues in breadth, more or less, according as the wind sets, and is high or lower. In the second place, this season is the most commodious for traveling over those countries; because, by means of the rain, which ordinarily falls after the grass is burnt, the game spread themselves all over the meadows, and delight to feed on the new grass; which is the reason why travellers more easily find provisions at this time than at any other."

A description of a typical spring forest fire as observed by one of the early travelers in eastern Virginia is given by Isaac Weld (70) in 1796:

> "As I passed through this part of the country, from Rappahannock to Urbanna, I observed many traces of fires in the woods, which are frequent, it seems in the spring of the year. I was a witness myself to one of these fires, that happened in the Northern Nec.
>
> "The day had been remarkably serene; in the afternoon, however, it became sultry, and streams of hot air were perceptable now and then, the usual tokens of a gust. About 5 o'clock the horizon towards the North became dark, and a terrible whirlwind arose. I was standing with some gentlemen on an eminence at the time, and perceived it gradually advancing. As it came along it leveled the fence rails, and unroofed the sheds for the cattle. We made every endeavor, but in vain, to get to a place of shelter; in the course of two minutes the whirlwind overtook us; the

shock was violent; it was hardly possible to stand, and difficult to breathe. The whirlwind passed over in about three minutes, but a storm, accompanied by heavy thunder and lightning, succeeded. On looking around immediately after the whirlwind had passed a prodigious column of fire now appeared in a part of the wood where some brushwood had been burning; in many places the flames rose considerably above the summit of the trees, which were of a large growth. It was a tremendous and at the same time sublime sight. The negroes in the surrounding plantations were all assembled with their hoes, and watches were stationed at every corner to give the alarm if the fire appeared elsewhere."

In writing of his experiences while a captive among the Indians, Hunter (30) in 1824, gave another reason for burning the woods:

"I think it must have been in the fall when I was taken prisoner, because the forests, and indeed the whole atmosphere, presented a smoky and peculiarly gloomy appearance; which most probably was owing to a custom which the Indians practise, of firing the leaves at this season of the year, to facilitate the collection of nuts for their consumption during the approaching winter."

The use of fire by the Indians in warfare is attested to by Maximilian, Prince of Wied, (62) in an account written in April 1833, while on a journey from eastern Kansas to northern Nebraska:

"In some places we saw smoke arising in the forest; in others, the trees and the ground were burnt quite black. Such fires are sometimes caused by the Indians, in order to escape the pursuit of their enemies, and sometimes, also, by the agents of the fur traders. We were told that the forest was green, this year, a fortnight earlier than usual."

On the same trip, while in eastern Nebraska, he made the following observation, on May 4, 1833:

"We had all around us beautiful low prairie hills, before which was alluvial land, thrown up by the river, covered with fine grass..... On the left bank there were whole tracts covered with dead poplars, which had been killed by the fires caused by the Indians in the forest and prairie."

Another instance of the Indians' custom of burning was told by Farnham (65) while traveling the old Sante Fe trail. Leaving Independence, Mo., on May 13, 1839, the following notations were made the following month, probably at some point in western Kansas:

> June 18th.- "The hills higher and more rocky; those in the distance to the west and northwest are partially covered with pines and cedars. Immediately around our track, the hills were clothed with dry bunch grass. Some of them had been burnt by the Indians. Many beautiful little valleys were seen among the highlands. Black birch, rose, and willow shrubs, and quaking-asp trees on the banks of the little brooks. Encamped under the cliffs of a butte. The moon was in the first quarter. Its cold beams harmonized well with the chilling winds of the mountains. The atmosphere all the day smokey, as in the Indian summertime in the highlands of New England."
>
> June 21st.- "The vales below had been set on fire by Indians."

A picturesque description of a forest fire in Texas was written by Flack (20) while he was on a hunting expedition there, in 1866. The fire, caused by lightning or a careless hunter, menaced the safety of those traveling in that vicinity.

> "Sometimes grand sights are seen in the woods: -- a dense jungle or cane-brake is set on fire, perhaps by lightning, or by the carelessness of some hunter. Thousands of acres will fall a prey to the flames; and the sight once seen, will never be forgotten."
>
> "High above everything, rising up towards the sky of deep blue, roll dense masses of smoke. Below, the red flames leap and twist and twine round the trees like thousands of huge fiery serpents, as they consume the light vines, and scorch the branches of the oaks. The canes blaze and crack with a loud noise, much resembling a continued fire of musketry. At once the wild inhabitants of the wood, both four-footed and winged, fly for their lives, in frantic terror. The clumsy bear, although he looks so slow and heavy, forces his way swiftly through the canes. The stealthy panther glides along with equal rapidity and less noise. Terrified herds of wild cattle dash through the jungle by sheer force of numbers and weight, snapping the thick canes as though they were bull-rushes. The frightened deer rush swiftly through the more open parts of the wood towards the prairie; while high over head the turkey, snipe, and other birds, fly in straight lines towards a secure resting place."

"The hunter also must hasten away, either to the prairie or to a stream of water broad enough to arrest the progress of the flames; and he may have even to fire the prairie in order to insure his safety."

Turpentining Fires

Throughout the longleaf region of the South, fire has been used as a protection measure in turpentining operations since the earliest days. Even this protective measure has not entirely prevented losses to turpentine orchards from accidental fires, although under the conditions existing, the use of fire as a protection measure has no doubt been justified. Sargent, (53) in a statement for the Tenth Census of the United States, published in 1884, describes turpentining fires and the frequency with which abandoned turpentine orchards are seriously damaged by fire.

"It is customary in the winter, in order to prevent the fires which annually run through the forests of the Southern Pine Belt from spreading to the boxes, to "racket" the trees; that is, to remove all combustible material for a distance of 3 feet around the base of each boxed tree. Fire, carefully watched, has then been set to the dry grass between the trees, in order to prevent the spread of accidental conflagrations, and to give the box-choppers a firmer foothold than would be offered by the dry and slippery pine leaves. In spite of these precautions, however, turpentine orchards, especially when abandoned, are often destroyed by fire. The surface of the box, thickly covered with a most inflammable material, is easily ignited, and a fire once started in this way may rage over thousands of acres before its fury can be checked."

Ashe (3) in 1894, deplored the practice of annually firing the longleaf pine country in eastern North Carolina, a practice which he said had been going on for 150 years prior to that time.

"The practice of firing the barrens has been adopted in many cases with a view to improving the pasturage; while in many other cases, after the trees were boxed, the leaves and trash pulled away from around them, the forests were burned over to prevent in a dry season a chance conflagration getting from under control and burning the faces of the turpentine boxes and the timber."

"Sooner or later the present management, or lack of management, which has characterized all dealings with the barrens for the past 150 years must be changed if the longleaf pine forests are to be made self-propagating."

In his treatise on the southern pines, Mohr (37) speaks of turpentining fires and how they often spread beyond the turpentine orchards:

"The greatest injury to which the pine forests are subject in consequence of turpentine orcharding arises from the fires which are started in the spring for the purpose of getting rid of the combustible matter raked from around the tapped trees in order to protect them from accidental conflagrations while they are worked. These forest fires, spreading far beyond their intended limits, destroy entirely the youngest progeny of the pines, stunt the growth of the more advanced trees, and cause the ruin of a large number of older ones in the abandoned turpentine orchards."

An additional reason for the annual turpentine fires in western Florida is given by Eldredge (19):

"The turpentine operator burns over his woods annually, after raking around his boxed trees, and at a time when burning will do least harm, in order to protect his timber from the later burnings that are sure to occur. He also burns to keep the turpentine orchards clear of undergrowth and free from snakes, in order that his negro laborers may gather the gum with ease and safety."

Early State Laws Requiring Burning

Carrier (9) quotes from Brickell (6) concerning an early law of North Carolina requiring that the country be burned over every 10th of March, although he did not agree with him as to the reason for the law:

"John Brickell in 'Natural History of North Carolina', 1737, wrote: 'As for hay, I never observed any made in the country, though they have such plenty of grass, that they are obliged to burn it off the ground every 10th of March, by virtue of a law made in the country for that purpose.'

"The purpose of this law was to burn the old unpalatable growth and renew the pastures with tender succulent grass rather than to get rid of an oversupply of forage as stated by Brickell."

Munns (52) mentions the same law, and that one of the early state governors, in 1752, considered the annual burning harmful. The law was repealed later on.

> "Apparently the practice of burning the open range was practiced at an early period. According to Bernard Rowans (1775) the object was to improve the grass and to develop better feed. Even at that time, however, there were those who did not believe in the use of fire. Thus Governor Dobbs of North Carolina complained bitterly (1752) of the practice of woods burning to improve the range or to burn the range with the idea that it eliminated the ticks. These fires, he asserted, injured the soil and the quality of the range. Early North Carolina law required that throughout the Province the range be burnt annually. This law was later repealed."

Early Fires and Prairie Formation

Many historians and early travelers contended that periodic burning influenced the formation of prairies and openings in the forest. That fires influence the character and density of vegetation has also been stated by a number of early observers. A few of these records will be included here--more to indicate the frequency with which the forests and prairies of the eastern United States were burned in the early days than to propound theories of the influence of fire on prairie formation.

Baldwin, (13) while traveling near the border of Georgia and Florida early in the nineteenth century, made the following observation:

> "There is, as yet, but little naked sandy desert; but should the weather continue, a few years longer, as dry as it has been for the last two years, - and fires should rage as extensively, destroying the vegetation, - a large portion of the maritime part of Georgia on the frontiers of Florida would be rendered like the deserts of Arabia. Were I a member of the Georgia Legislature, my most strenuous exertions would be made to prevent, by law, the burning of the Forests, - which impoverishes the land, and does incalculable mischief, without one single advantage resulting from it. Yet many of the stupid people do it, to destroy the rattle-snakes - make the grass grow - and I believe for the fun of looking at it."

The influence of frequent fires on prairie formation was held by Brockett (7):

> "The vast prairies and plains east of the Rocky Mountains had been so often burned over by the Indians, either carelessly or to promote the growth of grasses, on which the buffalo, their principal game, fed, that though in times long ago they were covered with heavy forests, they seemed to have lost their ability to sustain any large amount of timber. Only near the banks of streams was there any considerable growth of trees, and these, in some sections, only the comparatively worthless cottonwood."

The following is taken from Lowery (34):

> "According to Shaler (54): 'Undoubtedly the timberless character of the prairie country for at least two hundred miles west of the Mississippi is in the main due to the constant burning over of the surface by the aborigines.' There is ample evidence of a date somewhat later than that of the Spanish discovery, that the Indians, not only of the plains, but of the eastern section of our country, were in the habit of burning over the prairies and savannahs and firing the forest undergrowth, [in the account of Cambeca de Vaca and Dorantes, given in Oviedo, Vol. 3, page 606, it is said of the Texans: 'E tambien algunas vecia mantan venados e ponen fuego a la tierra e savannas para las matar,' (' and also sometimes pursue the deer and set fire to the ground and savannahs to kill them,')] a usage which could have a marked influence upon the subsequent forest growth of a district once burnt over and then deserted. For where a fire has consumed the trees, it by no means follows that the same characteristics will mark the new growth. Many species of the broadleaf trees sprout freely from the roots when killed back by fire, and a region once covered with pine may after repeated firings grow up in oak or less valuable deciduous trees."

The following observation was made by Nuttall (59) near Fort Smith, Ark., on April 29, 1819:

> "Took a walk into a prairie about 2 miles wide and 7 long. I found it equally undulated with the surrounding woodland, and could perceive no reason for the absence of trees, except the annual conflagration."

Ogden (60) in 1822 linked the prairies in Illinois to frequent fires.

"This State (Illinois), taken together, is somewhat more level than Indiana. However, the north western part is hilly and broken. The extensive valley, watered by the Illinois and its branches, is level or gently undulating. The prairies, on this river, are numerous, and many of them very large, extending further than the eye can reach; and some of them for sixty or seventy miles. These savannas or prairies, (but among the people of New-England, called swamps,) resemble large flat plains - (here the traveller is struck with wonder and amazement, - here he may, in many places, travel from the rising sun, until the going down of the same, without once having a hillock or a tree presented to his eye)- nothing but grass of luxuriant growth, waving in the breeze. These places (plains) it is supposed, were once covered with sturdy timber, but owing to their continual burning over by the aboriginals, in order the better to take their game, makes them appear what they now do.

"The new emigrant, at present in Illinois, builds his cabin in the edges of the timbered lands, and in the prairie ground, sufficient for his tillage, which he has no trouble of clearing. But the great distance from the timbered land, in many places, it being from ten to twenty, thirty to forty miles, will leave it thinly inhabited for some time. However, I have reason to believe if the fire was kept out, that these savannas would grow up and timber again; for in several places I observed where the fire had made such ravages, that small studdles of hickory were growing very thrifty, - and notwithstanding the penalty the legislature has inflicted on any one who shall be known to set fire to them, yet such is the lawless principle of these hunters, disregarding others good for the sake of game, that the fatal match is communicated, and the beautiful scenery is enveloped in flames, which frequently burns for weeks and months without cessation; which oftentimes impede travellers and movers in their progress, and is only put out by the watery element of heaven showering down upon it. Meanwhile the husbandman is in danger, and frequently suffers from the all-devouring flame. These awful conflagrations take place in autumn, when the grass and herbage upon these prairies are dry. It is at this season that the hunters calculate on procuring their skins. But as people are coming in whose habits of life are of a different kind, those people retire back like the wild game they pursue, and give place to industry and improvement."

Flagg (63) in 1836 described the prairies in Montgomery County, central Illinois, as follows:

> "The origin of these vast prairie-plains is, after all, no easy matter to decide; but, whatever the cause, they have doubtless been perpetuated by the autumnal fires which, year after year, from an era which the earliest chronicles of history or tradition have failed to record, have swept this surface; for, as soon as the grass is destroyed by the plough, the winged seeds of the cotton-wood and sycamore take root, and a young growth of timber sprouts forth. The same is true along the margin of creeks and streams, or upon sterile or wet prairies, where the vegetation does not become sufficiently heavy or combustible for conflagration to a great extent. These fires originated either in the friction of the sear and tinder-like underbrush, agitated by the high winds, or they were kindled by the Indians for the purpose of dislodging game. The mode of hunting by circular fires is said to have prevailed at the time when Captain Smith first visited the shores of Chesapeake Bay where extensive prairies then existed. These plains, by cultivation, have long since disappeared. Tracts of considerable extent in the older settlements of the country, which many years since were meadows, are clothed with forest."

Wyeth, (61) in April 1832, while traveling through southern Nebraska on a trip westward, noted the Indian custom of annually firing the prairie.

> "We came to a large prairie, which name the French have given to extensive tracts of land, mostly level, destitute of trees, and covered with tall coarse grass. They are generally dreary plains, void of water, and rendered more arid by the Indian custom of setting fire to the high grass once or twice a year to start game that has taken shelter there, which occasions a hard crust unfavorable to any vegetable more substantial than grass.... In sixteen days more we reached the River La Platte, the water of which is foul and muddy. We were nine days passing this dreary prairie."

Effect of Early Fires on the Forest

Phillips, an authority on the history of the South, describes the effect of forest fires in the Piedmont and lower Appalachian country (46), as follows:

"No white man ever saw the land in utterly virgin state, for here, as in many other quarters, the Indians before them had wrought considerable changes in the vegetation. Not only had they made petty clearings for tillage, leaving weedy "old fields", but by fire they had modified the forest far and wide. Some of the flames no doubt spread unawares from camp fires. Others were purposely set, whether to concentrate game in a narrowing circle for slaughter or to remove undergrowth and promote fresh herbage to attract game in future seasons. The effects were diverse. In some places, perhaps where fires occurred in time of drought, all the trees were killed and the land was converted into prairie, covered with grass, wild pea vines or canebrake, all of these furnishing pasturage. But more generally the result was a mere thinning of the forest by the killing of young growth, giving the greater trees more room in which to attain yet greater size."

That Indian burning was common in Connecticut is attested to by Trumbull, (67) who also noted the effect of these fires on the vegetation.

"When the English became first acquainted with that tract comprised within the settled part of Connecticut, it was a vast wilderness. There were no pleasant fields, nor cleared plots. Except in places where the timber had been destroyed, and its growth prevented by frequent fires, the groves were thick and lofty. The Indians so often burned the country, to take deer and other wild game, that in many of the plain dry parts of it there was but little small timber. Where the lands were thus burned, there grew bent grass, or as some called it, thatch, two, three, or four feet high, according to the strength of the land. This, with other combustible matter which the fields and groves produced, when dry in the spring and fall, burned with violence and killed all the small trees. The large ones escaped, and generally grew to a notable height and magnitude. In this manner the natives so thinned the groves that they were able to plant their corn and obtain a crop."

One of the early travelers in Florida, who made detailed observations of his journey, was William Bartram (68). During 1773, he described the vegetation along the shores of Lake George, in the central part of the state, as follows:

"The trees and shrubs which cover these extensive wilds are five or six feet high, and seem to be kept down by the annual firing of the deserts, rather than the barrenness of the soil, as I saw a few large Live Oaks, Mulberry trees, and Hiccories, which evidently have withstood the devouring flames."

In the same account, Bartram attributed the dark color of the rivers in the flat countries of Carolina and Florida to the annual woods fires, but found some difference in the country near Talahasochte, Fla., about 100 miles south of Oaquaphenogaw.

> "In all the flat countries of Carolina and Florida, except this isthmus, the waters of the rivers are, in some degree, turgid, and have a dark hue, owing to the annual firing of the forests and plains; and afterwards the heavy rains washing the light surface of the burnt earth into rivulets running rapidly over the surface of the earth, flow into the rivers, and tinge the waters the color of lye or beer, almost down to the tide near the sea coast. But here behold how different the appearance, and how manifest the cause! for although the surface of the ground produces the same vegetable substances, the soil the same, and suffers in like manner a general conflagration."

Nash (44) stated in 1895 that fires in the sand pine (Pinus clausa) thickets in Lake County, Fla., were comparatively rare.

> "The soil of these two sections was apparently originally the same pure white sand. That in the high pine land is now darker in color, being probably due to the charcoal deposited there by the annual fires. This seems to be the only difference. As fires are of rare occurrence in the "scrub", (thickets of sand pine) the plants have made no provision against it, and so when a fire does go through it causes great havoc, almost entirely killing the pines and the oaks. It is fortunate that the fires are of such rare occurrence."

Barker (5) held that forest and grass fires in Texas ceased with the coming of the whites, with the result that oak reclaimed much land formerly in prairie.

> "Texas consists, then, of two well-defined areas, differing one from the other in climate and in flora and fauna. The lowlands and the east may be not improperly designated the timber belt; the higher, treeless area of the northwest is known as the prairie region.
>
> "In the early days the prairie region extended further east than at present, due to the fact that the Indians frequently burned the prairies and destroyed all undergrowth. With the coming of the white man the prairie fires ceased, and much of the land that was formerly barren of trees is now overgrown with dense thickets of scrubby oak."

Father Vivier, an early French missionary, (56) after voyaging up the Mississippi River, wrote a letter while 'among the Illinois', on November 17, 1750, in which he described the country on both sides of the river:

> "Both banks of the Mississippi are bordered, throughout nearly the whole of its course, by two strips of dense forests, the depth of which varies more or less from half a league to four leagues. Behind these forests the country is more elevated, and is intersected by plains and groves, wherein the trees are almost as thinly scattered as in our public promenades. This is partly due to the fact that the savages set fire to the prairies toward the end of autumn, when the grass is dry; the fire spreads everywhere and destroys most of the young trees. This does not happen in the places nearer the river, because, the land being lower, and consequently more watery, the grass remains green longer, and is less susceptible to the attacks of fire."

According to Hough, (29) forests frequently swept by fire build up a resistance to its effect.

> "If, as appears probable, forests have been swept by fire at intervals throughout their history, it is likely that there has been established in some tree species a resistance to the effects of heat. There may be seen in the thickening of the bark near the ground perhaps a protective device. In general, the damage of forest fires is related to the amount of litter on the forest floor and the species of trees. Young replacement growth in most cases suffer."

Although fires were of frequent occurrence on the longleaf hills in central Alabama, where one of the early Forest Service studies was made, Reed (49) noted (in 1905) that the moisture along the creeks prevented fire there.

> "Surface fires have been prevalent ever since anything was known about the country. It used to be the custom of the Indians to burn the woods to facilitate hunting, and the white settlers have kept up the practice to improve the grazing.
>
> "The constantly moist soils of the creek land have prevented fires from having any appreciable effect on this part of the forest; but on the longleaf pine land,

where from late summer to early spring the ground cover, except during or immediately after rain, is in a constantly dry and inflammable condition, fires have occurred with increasing frequency, until now it is rare for any considerable area to pass a year unburned. Some portions are burned twice within a year."

Several of the early observers on forestry conditions in the South commented on the resistance of longleaf pine to frequent fires. One of the first of these was Sir Charles Lyell, (35) who described the country in central Alabama while traveling there in February, 1846.

"Starting in a northeasterly direction, we first entered a hilly country formed of sandstone, grit, and shale of the coal formation, precisely like the strata in which coal occurs in England. These hills were covered with long-leaved pines, and the large proportion they bear to the hard wood is said to have been increased by the Indians practice of burning the grass; the bark of the oak and other kinds of hard wood being more combustible, and more easily injured by fire, than that of the fir tribe. Everywhere the young seedlings of the long-leaved pine were coming up in such numbers that one might think the ground to have been sown with them; and I was reminded how rarely we see similar self-sown firs in English plantations. When we had gone about twenty miles northeast of Tuscaloosa, we came to a higher country, where nearly all the pines disappeared, and were replaced by oak, hickory, sumach, gum-trees, sassafras, and many others. In some clearings here, as in the Carolinas, the quantity or cordage of wood fit for charcoal produced in thirty years by the new growth, is said, from its greater density, to have equaled the wood contained in the aboriginal forest."

Drake (15) in describing the longleaf forest along the lower Gulf Coast country in 1850, described the longleaf forest as he saw it by the light of a surface fire at night:

"The prevailing and characteristic forest tree of this plain is the long-leafed pine; which in many parts, as between Pensacola and Mobile, forms a dense and lofty forest, to the exclusion of almost every other tree. These pines seen at night, by the running fire that occasionally consumes their shed cones and

long leaves, with the dry grass among which they have fallen, presents a grand and striking spectacle. This conflagration is one cause why so little humus, or mold, accumulates on the surfaces; another is that but little mold is generated by the exuviae of a pine forest, and hence the surface remains barren."

In 1860, Hilgard (27) described the same region and told how the regular burning as practiced by the Indians kept the forest open and park-like, whereas the wasteful burning of the later settlers resulted in enormous waste and destruction. He also suggested that burning can be done advantageously at certain times.

"The herbaceous vegetation and undergrowth of the longleaf pine region is hardly less characteristic than the timber. Whenever the regular burning of the woods, such as practiced by the Indians, has not been superseded by the irregular and wasteful practice of the later settlers, the pine forest is almost destitute of shrubby undergrowth, and during the growing season appears like a park, whose long grass is often very beautifully interspersed with brilliantly tinted flowers."

"It is not the province of this Report to suggest municipal regulations by which the burning of the woods at improper seasons might be prevented, or at least, rendered of less general occurrence;..."

"However convenient and effectual may be the burning of the dry grass in order to render the young growth accessible to cattle, that advantage is certainly purchased very dearly at the cost of its total destruction within a few years--a policy little better, in fact, than cutting down a fruit-tree for its fruit; and which appears more especially irrational when we consider how easily the advantage could be reaped without incurring the enormous waste, by a regular system of burning at times when, as after the first autumnal rains, and more especially in early spring, the ground is too wet to allow of injury to the roots, while yet the grass and weeds may be burnt off low enough to serve all practical purposes, and to destroy, at the same time, the blackjack and post oak undergrowth, which is equally fatal to the range, with the fire itself. For the latter purpose, the burning in early spring, when the sap is rising, would be the most favorable time."

That longleaf pine can reproduce itself under conditions of annual burning was observed by Andrews (1) in Floyd County, in northwestern Georgia.

> "The southern slopes are covered with the remains of great forests of this valuable timber (longleaf), interspersed with various hardwood trees and with shortleaf pines (P. virginiana and P. echinata). They have repeatedly been cut for lumber and burned over by "ground fires" started in spring by farmers to provide a free range for their cattle, but the longleafs continue to reproduce themselves with a pertinacity which, if not too diligently thwarted by the blundering incompetence of county officials and the short-sighted greed of ignorant timber cutters, will in the course of a generation or two repopulate the southern mountain slopes with a new forest growth sprung from the old stock."

As early as 1889, Long (33) stated that the chief reason for the occurrence of great stands of longleaf pine in the South was the annual burning of the woods:

> "The annual burning of the wooded regions of the South is the prime cause and preserver of the grand forests of "P. palustris" to be found there; that, but for the effect of these burnings, the pine forests would never have been, and but for the continual annual wood firing that prevails so generally throughout the South the Maritime Pine Belt would soon disappear and give place to a jungle of hard wood and deciduous trees."

> "With each recurring annual burning all plants which have sprung up in the woodlands since the preceding spring, are overtaken and are readily destroyed when the dry grass and leaves take fire in the fall."

Summary

A review of the literature bearing on the subject of early grass and forest fires in the United States east of the Rocky Mountains leads to the following conclusions:

1. Fires were common even before white settlement took place, started either by lightning or by the aborigines.

2. The American Indians habitually burned the woods, both before and after settlement of the country by the whites. These fires were chiefly used in connection with hunting, either to surround the game, such as deer and buffalo, with fire, thus making it easier to confuse the animals and kill them; to keep down the underbrush to facilitate travel during hunting expeditions and to see the game at a distance; or to attract game to the fresh grass which follows burning. The Indians also used fire in clearing woodland for agriculture, in warfare, and for various other reasons.

3. The early white settlers followed the Indian custom of woods-burning and probably were more systematic at it than the Indians. An example of this is an early law in North Carolina, which made it compulsory to burn the woods every spring.

4. Much of the early woodsburning, by both Indians and whites, was done unintentionally, such as where fire escaped from the camps of hunters or travelers, or during brush-burning and clearing operations, and spread to the surrounding country.

5. The most common cause of grass and woods fires since early settlement by the whites has been for the purpose of removing the accumulation of litter, dead grass and herbaceous vegetation during the winter or early spring, so that fresh grass would be more readily available to livestock, principally cattle.

6. Annual burning as a protective measure in turpentining operations has been common practice since Colonial days. This practice has been limited to the longleaf and slash pine forests of the southeastern states and to the areas where turpentining was in progress.

7. Frequently recurring fires over a long period of time influence vegetative cover types. Some people contend that frequent fires were influential in the formation of prairies from what was originally forest. Others claim that fires were essential to the development of the longleaf pine forests in the southern states.

8. Forest and grass fires have occurred annually or periodically over a large part of the eastern United States, both before and since white settlement took place.

Forests that show no evidence of fires are extremely rare today. Complete exclusion of fire over extensive areas of forest land has only come about through organized fire protection during the last two decades. With increased fire protection, the area burned each year can be expected to decrease. As a result of complete exclusion of fire, ecological conditions will change. Foresters should not overlook these facts in the development of forest management plans in this region.

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